2. Phase Transition in Two-Dimensional Random Antiferromagnets Rb_2Co_CNi_<1-C>F_4

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ABSTRACT

Neutron scattering and specific-heat measurements have been made for the study of phase transition in randomly mixed antiferromagnets. The samples used in the present study were single crystals of $Rb_2Co_cNi_{1-c}F_4$ in which Ni^{2+} ions were randomly replaced by Co^{2+} ions according to concentration c. The pure materials, Rb_2CoF_4 and Rb_2NiF_4, are having so-called K_2NiF_4 structure. Magnetic properties of these two materials in the critical region are of truely two-dimensional (2D) and the exchange constants are anisotropic with Ising symmetry. It has been known that their static critical phenomena coincide exactly with that of 2D Ising model.

It is the purpose of this paper to show experimentally whether or not the spacial randomness of magnetic atoms has an effect on the phase transition, i.e. what kind of change is to be caused in the cooperative phenomena through the additional condition, disorder. Specifically, it is hoped to make sure whether phase transition in mixed crystals occurs sharply quite equal to that of pure materials or smearing of the phase transition which has been measured in a number of previous reports is essential. And discussion about universality of critical exponents and critical-amplitude ratio is to be made.

We have measured magnetic specific-heat capacity for the crystals $Rb_2Co_cNi_{1-c}F_4$ with concentration c = 0.8, 0.65, 0.5, 0.14 and 0.0 by means of A.C. calorimetric meathod. Temperature dependence of sublattice magnetization has been also measured for samples with concentration c = 0.5 and 0.8 using neutron elastic scattering technique and for c = 0.5 measurements on critical neutron scattering have been undertaken.

It has been clarified that sharp 2nd order phase transition can occur even in mixed crystals equally in pure crystals, if the randomness of samples was completely homogeneous. The results of these experiments showed that the static critical exponents, α, β, γ and ν, of all these samples corresponded to those of 2D Ising model. In addition, qualitative discussion was made on the universality of the critical-amplitude ratio.